Strand Lighting Limited Grant Way (off Syon Lane) Isleworth Middlesex TW7 5QD United Kingdom
Telephone 081 560 3171 Telex 27976 STRAND G Fax 081 568 2103

Strand Lighting

Document : 7Z0046

Disclosure : Training

Issue : 01

Header page : 1 of 4

M24 UPGRADES HANDBOOK

CONTENTS PAGE

Preface.

All Approved Service Centres will be supplied with one copy of this technical training handbook. This copy are supplied for information only. Strand Lighting will not approve the use of information contained within this handbook by persons who have not attended training courses at Strand Lighting.

The front cover, the contents pages and this introduction page form the header document for this handbook. This header document has a unique document number which should always be quoted when referring to the whole handbook.

Each time there is a change or an addition to the handbook a supplement will be written. The supplement will be put at the end of the main text and will have another document number.

Each time a supplement is written the header document is updated. The supplement is added to the contents pages and the issue number of the header document is incremented.

To check that your copy of this handbook is up to date contact Strand Lighting Engineering Service and quote the number and issue of the header document. If your document is not the latest issue you will be sent the latest header document and the missing supplements.

Header document number	:- 7Z0046	Issue :- 01
Main text document number	:- 7Z0046	Issue :- 01

The information within this handbook is believed to be correct and complete, however if you discover any omission or error, please contact Strand Lighting.
Strand Lighting accepts no responsibility or liability for any errors or omissions which may have occurred during the preparation of this guide.
Strand Lighting accepts no responsibility or liability for any damage, loss or injury, however caused from the use of information contained within this guide.

Electricity at Work Regulations - 1989.

The Electricity at Work Regulations 1989 require :-

"No person shall be engaged in any work activity where technical knowledge or experience is necessary to prevent **danger** or, where appropriate, **injury**, unless he possesses such knowledge or experience, or is under such a degree of supervision as may be appropriate having regard to the nature of the work." (Guidance on regulations - published by HSE)

"It is for the employer to judge the level of competence required, and to ensure that no person is called on to carry out work for which he does not have the required competence. This is very much a matter of individual judgement, but the employer must always bear in mind the fact that he may be required to justify his decisions before a court of law in the event of an accident." (Guide to Electrical Safety at Work - John Whitfield - Published by E.P.A. Press)

Successful completion of the course and the assessment does not, by itself, necessarily provide the trainee with the knowledge or experience to comply with this requirement.

To satisfy the requirement the following three stages must be completed.

1. Pre-Qualification.

   Before attending a course at Strand, the trainee must be able to demonstrate "adequate knowledge of electricity" and "adequate experience of electrical work". This knowledge and experience will probably have been gained from a BTEC, City and Guilds or other vocational qualification.

2. Theory and Identification of Hazards.

   The course at Strand Lighting will include understanding of the system to be worked on, understanding of the hazards which may arise during the work and any precautions which need to be taken.

3. Practical Experience.

   Finally the trainee must gain practical experience of the class of system which is being worked on. He must also be able to recognise at all times whether it is safe for work to continue. These requirements are not taught at Strand Lighting.

All maintenance courses are assessed. Engineers who pass the assessment will have demonstrated that they have the required theoretical understanding of the system, understanding of hazards and the precautions to be taken. The engineer may now proceed to the next stage which involves gaining practical experience of the type of electrical equipment covered in the course.

Engineers who have attended courses prior to the introduction of the assessments, and have had regular experience of the product, should still have sufficient understanding of the system and understanding of the hazards. Engineers who have not had regular experience should attend a refresher course and take the assessment.

TEMPUS M24 UPGRADES HANDBOOK

1. INTRODUCTION

This handbook contains three sections:-

Section 1 - Hardware Modifications

This section details all modifications and improvements which have been specified for M24 equipment since its initial release.

Section 2 - Software Updates

This section details the fitting and use of improved software which allows the M24 system to control up to 120 channels as well as incorporating other enhancements.

Section 3 - Expansion

This section deals with the expansion of M24 facilities to handle up to 120 channels and 199 memories.

II Terms and Definitions

P.C.B.	Printed Circuit Board
Component Side	Side of P.C.B. on which most components are mounted.
Copper Side	Other side of P.C.B.
R.A.M.	Random Access Memory
PROM	Programmable Read Only Memory
PTFE	Poly Tetra Fluoro Ethylene A heat resisting plastic
I.C.	Integrated Circuit
R	Resistor
C	Capacitor
RV	Variable Resistor - potentiometer
VT	Transistor
DISP	Display
	Circuit designation numbers usually follow component abreviation, and may be suffixed by pin numbers. e.g. I.C. 2/10 = Integrated Circuit No. 2, pin 10.
Track Break	A method of disconnection effected by cutting a P.C.B. track with a sharp blade and removing a section about 1.5mm long.
Wire Tack	A technique of attaching extra wires to P.C.B.'s using a silicone compound or specially made adhesive.
	Adhesive is applied in 'blobs', away from solder joints to attach the wire at intervals along its lengths.

III **WARNING**

M24 INCLUDES MANY INTEGRATED CIRCUITS WHICH CAN BE DAMAGED BY STATIC ELECTRIC DISCHARGES.

DO NOT REMOVE OR INSERT COMPONENTS IN AREAS WHERE STATIC ELECTRICITY IS LIKELY TO OCCUR. IDEALY, MODIFICATIONS SHOULD ALWAYS BE CARRIED OUT IN A WORKSHOP WITH A TILED OR WOODEN FLOOR AND ON A CONDUCTIVE BENCH TOP WHICH IS EARTHED.

BEFORE TOUCHING INTEGRATED CIRCUITS, DISCHARGE ANY STATIC ELECTRICITY FROM THE BODY BY TOUCHING THE EARTHED BENCH TOP.

DO NOT WEAR CLOTHING WHICH IS MADE WHOLLY FROM MAN-MADE FIBRES. DO NOT WORK IN AREAS WHERE THE FLOOR IS COVERED WITH CARPET EVEN IF THE CARPET HAS BEEN TREATED TO PREVENT BUILD-UP OF STATIC ELECTRICITY (SUCH TREATMENTS ARE NOT 100% EFFECTIVE). ALWAYS ENSURE THAT INTEGRATED CIRCUITS ARE PROTECTED BY INSERTING THEM INTO CONDUCTIVE FOAM OR TUBES WHENEVER THEY ARE NOT FITTED INTO P.C.B'S.

NEVER ATTEMPT ANY MODIFICATIONS OR COMPONENT CHANGES UNLESS THE UNIT IS TOTALLY DISCONNECTED FROM THE MAINS SUPPLY.

1. Hardware Modifications

The list of modifications gives instructions about implementation, with diagrams where necessary, together with the reasons why and when each modification is required.

A list of materials required for each modification is also given - should materials not be available locally, they may be obtained from Rank Strand Engineering Services Department. Certain materials, such as some program PROM's may be available free of charge, as long as the original parts are returned to Rank Strand.

Depending on the date of supply of the equipment, some, or all of the modifications may have already been done.

A large proportion of the modifications are to be done as part of routine service. This means that no special arrangements should be made to perform these modifications, but that they should form part of a standard procedure which is followed whenever units are returned for service.

Wire links should generally be fitted to the copper side of the PCB.

1.1 Tempus M24 Console Motherboard Ref. 1832

1.1.1 Using 0.5mm^2 PTFE insulated wire, link IC 22/14 to IC 25/14 to IC 29/14, link IC 22/28 to IC 25/28 to IC 29/28.

Add a 0.1 F 50V disc ceramic capacitor between pins 14 and 28 on each of IC's 22, 25, 29. Attach the capacitors on the copper side of the P.C.B. and make the leads as short as possible.

See Figure 1

Reason for Modification:-

The instantaneous power demand of PROM's IC's 22, 25, 29 can generate severe noise spikes on the OV and +5V power rails causing incorrect microprocessor action, and system failure. The addition of the wire links and capacitors reduces the power rail impedance.

Action required:-

All units supplied after 140384 have been modified by Rank Strand. Units supplied before 140384 should be modified as part of routine service, or if the customer experiences inexplicable system 'crashes'.

Materials required:-

0.5mm^2 PTFE insulated wire.
0.1 F 50V disc ceramic capacitor - 3 off.

1.1.2 Change program version A1 in Intel PROM's to program version A2 or later in Mitsubishi or Hitachi PROM's.

Reason for Modification

Intel PROM's require very heavy instantaneous currents from the power supply, even with mod. 1.1.1. implemented. This can cause noise spikes on the power rails and can adversly affect microprocessor operation.

Action required:-

Only systems supplied before 011084 were fitted with Intel PROM's. Such systems should be checked, and the program replaced, as part of routine service, or if the customer experiences system 'crashes'.

Materials required:-

Set of 3 Mitsubishi or Hitachi 2764 PROM's programmed with M24 console program A2 or later.

1.1.3 IC 53 (SN 74LS156N) must be a Texas Instruments type only. If it is of another manufacturer, change it for a Texas Instruments I.C.

Reason for Modification-

Other manufactures devices may be made to a slightly different specification. This difference may cause memory corruption during power up or down.

Action required:-

All units supplied after 140384 will have been checked by Rank Strand. Units supplied before 140384 should be checked, and modified if necessary, during routine service, or if the customer experiences inexplicable memory corruption.

Materials required:-

Texas Instruments SN 74LS156N I.C. - 1 off.

1.1.4 Change IC 51 from MC 1456P to TL081 ACP. (If TL081 is difficult to obtain a TL071ACP, TL071BCP, or TL081BCP may be used).

Reason for Modification:-

The faster slew rate of the TL081 ACP improves the stability of the analog circuitry. This in turn reduces the chance of channel levels 'Flickering' on the V.D.U.

Action required:-

Implement modification if the customer is experiencing 'flickering' of levels on the V.D.U.

Materials required:-

TL081ACP (or specified alternative) - 1 off.

1.2 **Tempus M24 Console Front Panel Ref. 1833**

1.2.1 Add a 220pF capacitor, Mullard type 632, between IC 11/6 and OV. Fit capacitor on copper side of P.C.B. See figure 2.

Reason for Modification:-

Capacitor reduces noise on IC 11/6 preventing possibility of panel powering-up in the wrong mode and causing the message 'NO PANEL RESPONSE' on the V.D.U.

Action required:

Units supplied after 140384 have been modified by Rank Strand. Units supplied before 140384 should be modified as part of routine service, or if customer complains of 'NO PANEL RESPONSE' error messages.

Materials required:-

220pF capacitor, Mullard type 632 - 1 off.

1.2.2 Remove solder resist coating from earth pad. Remove from pad on both sides of the P.C.B. See figure 2.

Reason for modification:-

Solder resist prevents proper earthing of front panel metal work. Proper earthing is required to reduce adverse effects on the M24 from electrical interference and static electricity.

Action required:-

Units supplied after 140384 have been modified by Rank Strand. Units supplied before 140384 should be modified as part of routine service or if customer complains of otherwise inexplicable problems - especially with the front panel processor.

Materials required-

None.

1.2.3. Remove R34 (3K3)

Reason for Modification:-

R34 is not required for correct circuit operation.

Action required:-

Modify units as part of routine service.

Materials required:-

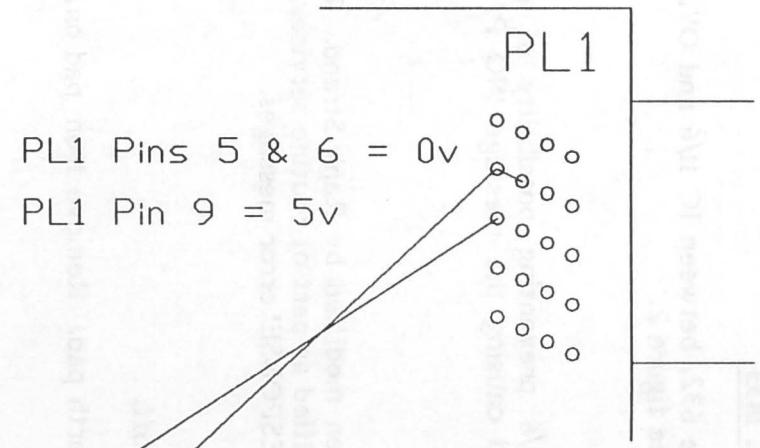
None.

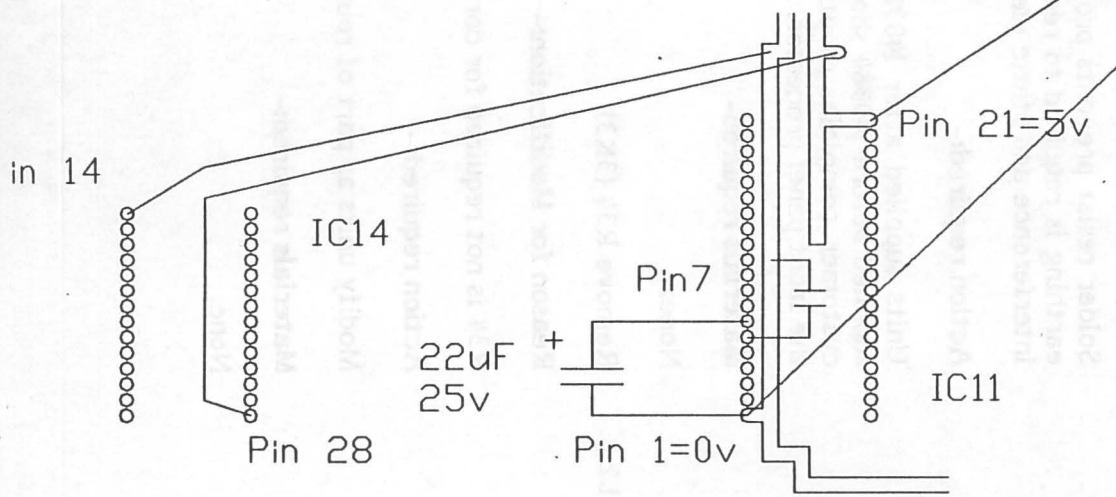
Additional modifications to the M24 front panel.

Connect 0v from the ribbon cable connector PL1 pins 5 and 6 to IC11 pin 1. Next connect the 0v from the 0v power rail to IC14 pin 14.

Connect 5v from the ribbon cable connector PL1 pin 9 to IC11 pin 21. Next connect the 5v from the power rail to IC14 pin 28.

Connect a 22uF 25v Capacitor to IC11. The negative end to pin 1 (0v) and the positive end to pin 7 (5v)





The capacitor shown on IC11 pin 6 is detailed in the upgrade handbook section 1.2.1

1.3 **Tempus M24 Console Video Interface Ref. 1834**

1.3.1 Cut track to IC 11/25 ensuring that IC 3/11 remains connected to IC 7/9. Fit 100R resistor across the track break.

Fit a 470pF capacitor, 630 series, between IC 11/25 and OV. Implement modifications on copper side of P.C.B. See figure.

Reasons for Modifications:-

The Video timing generator I.C. type SY6545A-1 is now obsolete. The replacement type, SY6845EA has a slightly different specification requiring the modification.

Action required:-

Implement the modification ONLY if replacing IC 11 with a device type SY6845EA.

Materials required:-

100 R resistor, Mullard type CR 25 - 1 off
470pF capacitor, 630 series - 1 off

1.4. **Tempus M24 Effects Unit Power Supply Ref. 1830B**

1.4.1. Remove R5, R6, R7 (0.22R), change fuses 1 and 2 from 5A quick blow to 2A quick blow. Check that C4 is 1000pF and replace if it is not.

Reason for Modification:-

The maximum output of the +5V supply is now restricted to 2.5A. Under fault conditions a higher current causes damage to the power supply through transformer regulation.

Values of C4 larger than 1000pF give rise to excessive ripple on the +5V power rail.

Action required:-

This modification is only applicable to units supplied before 011283. Check any units returned for service and modify if necessary.

Materials required:-

2 Amp 20mm quick blow fuse - 2 off
1000pF chip ceramic capacitor - 1 off

1.5 Tempus M24 Effects Processor P.C.B. Ref. 1857

1.5.1 Add 1N914 diode between the junction of R84 and D2, and 'Reset' (DIS 1/3). The cathode of the diode must connect to DIS 1/3. The diode should be mounted on the component side of the P.C.B. by drilling two holes in the P.C.B. Wire links should then be used to connect the diode into the circuit.

See figure 3.

Reason for Modification:-

The modification ensures that an oscillator formed by IC27 and IC28 starts running when the unit is switched on.

Action required:-

Units supplied after 010284 have been modified by Rank Strand. Units supplied before 010284 should be modified as part of routine service or if the customer complains that the unit does not always operate in 'stand alone' mode.

Materials required:-

1N914 diode - 1 off
0.5mm^2 PTFE insulated wire.

1.5.2 Add 33pF chip ceramic capacitor between IC 23/4 and Analog OV (R136). Fit capacitor on component side of P.C.B.

See figure 4.

Reason for Modification:-

The modification is to suppress noise on the D master.

Action required:-

Units supplied after 140984 have been modified by Rank Strand. Units supplied before 140984 should be modified as part of routine service or if customer complains of interference on the D master.

Materials required:-

33pF Chip ceramic capacitor 1 off.

1.5.3 Increase R37 and R38 from 1K to 1K5.

Reason for Modification:-

The modification ensures that channels which are OFF during a 'Flash' effect do not show levels of 00% or 01% on the M24 V.D.U.

Action required:-

Units supplied after 140984 have been modified by Rank Strand. Units supplied before 140984 should be modified as part of routine service or if customer complains of spurious V.D.U. readings during 'Flash' effects.

Materials required:-

1K5 resistor Mullard type CR25 - 2 off.

1.5.4 Break track from IC 37/4 by R153. Drill out through hole towards other end of the same track, in the vicinity of RV14. Link this, now isolated, track to Analog OV between IC 23 and IC 24. Connect R153 to track from C37 with a PTFE insulated wire link. 'Tack' the wire link to the P.C.B. at approximately 60mm intervals. Implement modifications on the copper side of P.C.B.

See figure 4.

Reasons for Modification:-

Original track layout gives rise to cross talk between tracks, causing interference on Master H.

Action required:-

Implement modification if interference is noted on Master H.

Materials required :-

0.5mm^2 PTFE insulated wire.

1.5.5 Fit D98 and D99

Reason for Modification:-

The modification enables the Effects unit to operate upto 120 channels.

Action required:-

Units supplied after 140984 will have the extra diodes fitted as standard. Units supplied before 140984 should be modified if the customer requires additional channel capacity above 60 channels, or as required for compatability between service units.

Materials required:-

1N914 diode 2 - off.

1.5.6 Fit a 0.1 uF 50V disc ceramic capacitor between pins 14 and 28 of IC 14. Fit the capacitor on the copper side of the P.C.B. and make the leads as short as possible.

Reason for Modification:-

The instantaneous power demand of PROMIC 14 can generate severe noise spikes on the OV and +5V power rails. The capacitor suppresses this noise.

Action required:-

Units supplied after 011184 have been modified by Rank Strand. Units supplied before 011184 should be modified as part of routine service, or if the customer experiences inexplicable Effects Panel 'crashes'.

Materials required:-

0.1 uF 50V disc ceramic capacitor - 1 off.

1.6 **Tempus M24 Multiplex / Demultiplex Unit**

1.6.1 Change R66 to a varistor type GEV24ZA50.

Reason for Modification:-

As a varistor is a device which only conducts when a certain voltage is applied across it, it provides isolation between Mains Earth and Technical Earth, except under fault conditions. This removes a likelihood of 'earth loops' whilst giving better protective earthing should a fault occur which would otherwise apply a high voltage to the Technical earth.

Action required:-

Modify units if 'earth loops' in the Technical earth are otherwise unavoidable because of site conditions/regulations.

Materials required:-

Varistor type GE V24ZA50 - 1 off.

2. Software Updates

2.1 Program Versions

M24 Console

There are three versions of M24 Motherboard program which are likely to be found in units:-

Version A1 - This version was the original M24 program and was fitted to all systems supplied before 011084.

It supports a maximum channel capacity of only 60 channels.

Version A2 - This version of program supports a maximum channel capacity of 72 channels. It was fitted to all M24 consoles supplied between 011084 and 300485.

Version B1 - This version of program supports a maximum channel capacity of 120 channels, as well as a memory expansion unit. It is fitted to all M24 consoles supplied after 010585.

2.2 PROM Types

Program version A1 was normally supplied in Intel D2764-4 EPROM's. These PROM's were found to require very heavy instantaneous currents from the power supply. This in turn caused problems with system reliability.

Program versions A2 and B1 are supplied in Mitsubishi or Hitachi 2764 EPROM's which require considerably smaller instantaneous currents.

Program version A1 should therefore be replaced with either A2 or B1 in Mitsubishi or Hitachi PROM's. This replacement should form part of a normal service routine, or should be done if the customer experiences reliability problems.

M24 front panel program has remained unchanged at version A1 which is fully compatible with all three motherboard program versions.

M24 Effects.

All M24 Effects units have been supplied fitted with FX program version A2. Program version A3 will be released shortly. Version A3 includes enhancements which will improve the reliability of the 'Load Output' function. Updating from A2 to A3 should only be done if the customer experiences problems with 'Load output'.

2.3 Replacement of Programs

Program updates are supplied by Rank Strand. THESE DEVICES ARE STATIC SENSISTIVE AND MAY BE DAMAGED DURING HANDLING. They are supplied in protective packing and should not be removed from this until just before they are fitted.

To change PROM's

a) Remove the unit's back cover.

b) For an Effects unit, remove the P.C.B. from the case.

c) Gently remove the PROM's from their sockets, ensuring that the pins are not bent. A flat bladed screwdriver may be useful in starting the removal but care must be taken not to damage either the PROM, the socket, or surrounding components and track.

d) Place the PROM's on a conducting surface, or in protective packing.

e) Remove the replacement PROM's - one at a time - from their packing and fit them into their sockets - ensuring correct placing and orientation.

f) Pack the original PROM's in the protective packing and return them to Rank Strand.

g) Re-assemble the unit and test.

3. Memory Expansion / Channel Expansion

3.1 Memory Expansion

The Memory Expansion kit comprises only a single plug-in P.C.B. which hold 16 Kilo-bytes of R.A.M.

To fit the P.C.B., remove the back cover of the M24 console, plug the P.C.B. into one of the un-used connectors near the Video interface P.C.B. and tighten the screw in the retaining bracket.

The memory Expansion can only be used if program version B1 or later is fitted to the console. Therefore the program must be updated if it is version A1 or A2.

In order to enable the Memory Expansion, Switch 1 bit 6, on the Motherboard, must be closed.

To check the newly fitted memory, run the system diagnostics, in particular, the Motherboard diagnostic test 6 - Cue Store RAM.

The Memory Expansion allows the maximum number of recordable cues to be increased to 199, for systems having channel capacities upto 96 Expansion of channel capacity above 72 is only possible if the system has a Memory Expansion P.C.B. fitted.

3.2. Channel Expansion

Channel capacity expansion to between 72 and 120 channels is a simple matter of re-adjusting the Motherboard 'magic switches', once program version B1 and a memory expansion P.C.B have been fitted.

Switch Settings.

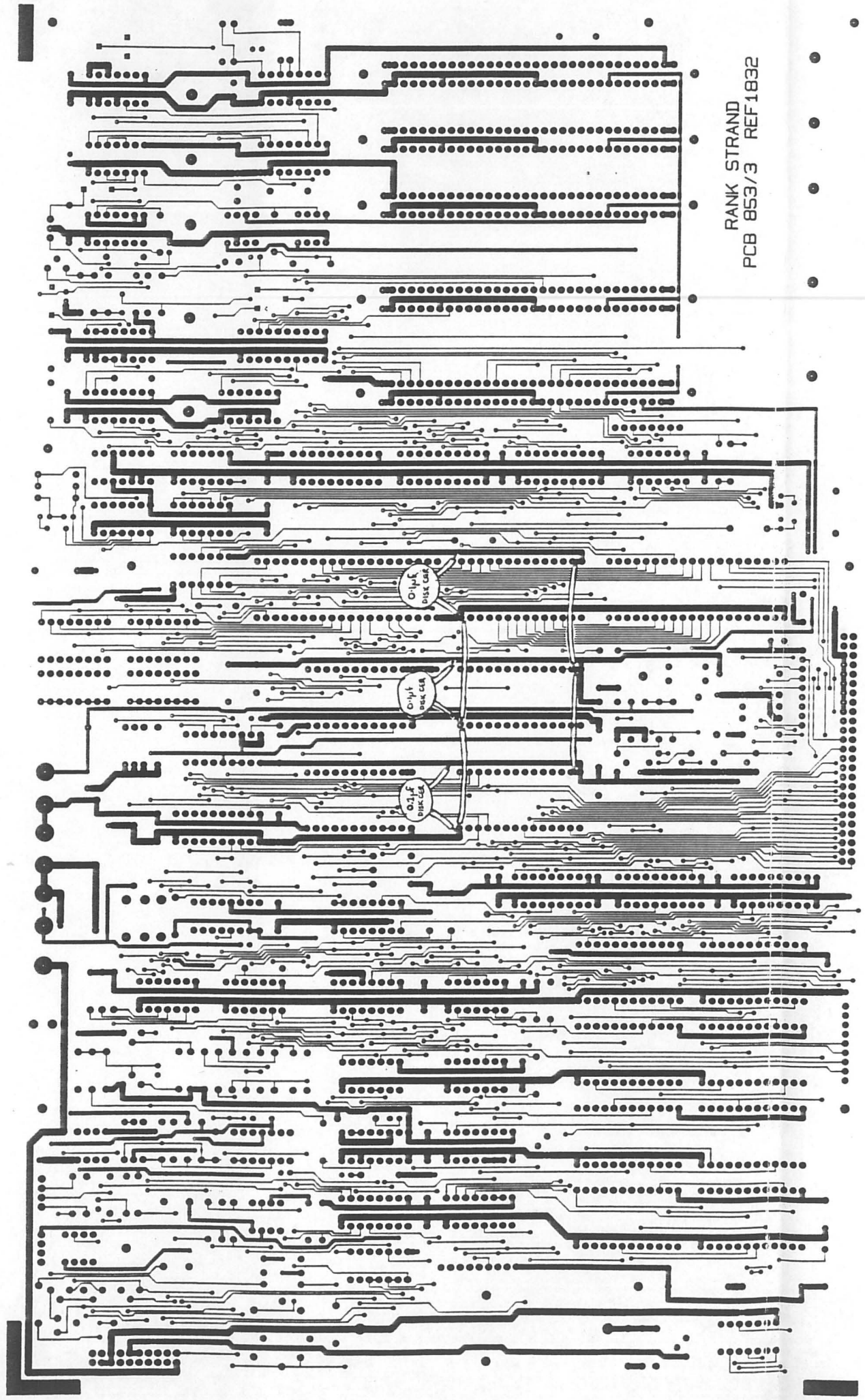
	SW1/1	/2	/3	/4
12 Chns	C	0	0	0
24	0	C	0	0
36	C	C	0	0
48	0	0	C	0
60	C	0	C	0
72	0	C	C	0
84	C	C	C	0
96	0	0	0	C
108	C	0	0	C
120	0	C	0	C

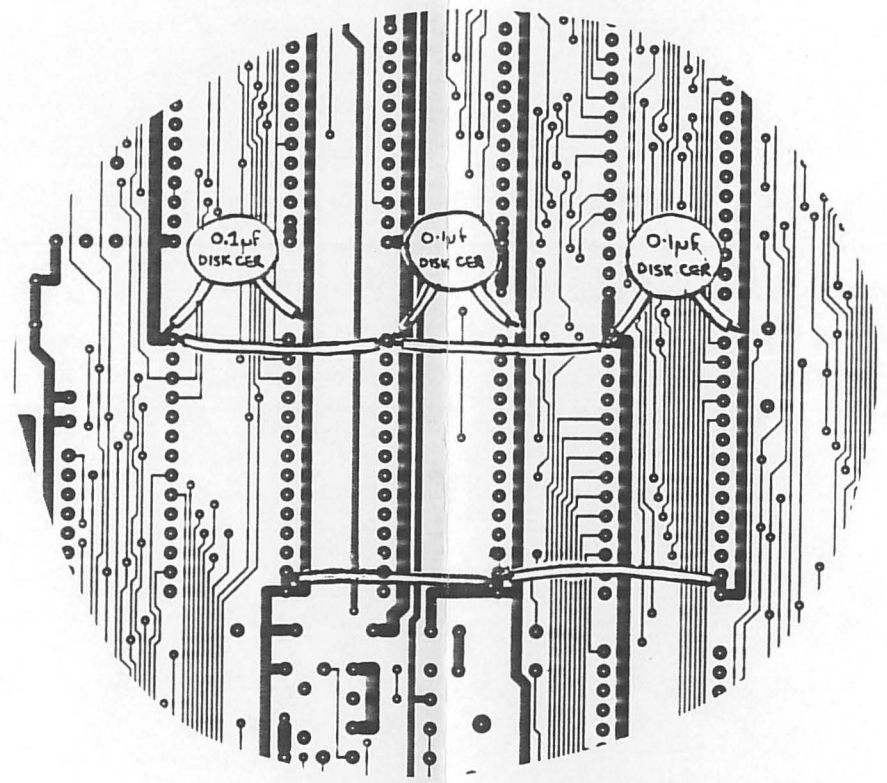
0 = Switch in OPEN position
C = Switch in CLOSED postion

Extra demultiplex facilities will be required for the additonal channels. These will need to be set up to respond to the desired groups of channels.

If an Effects unit forms part of the installation this may require modification to allow the additional channel capacity.

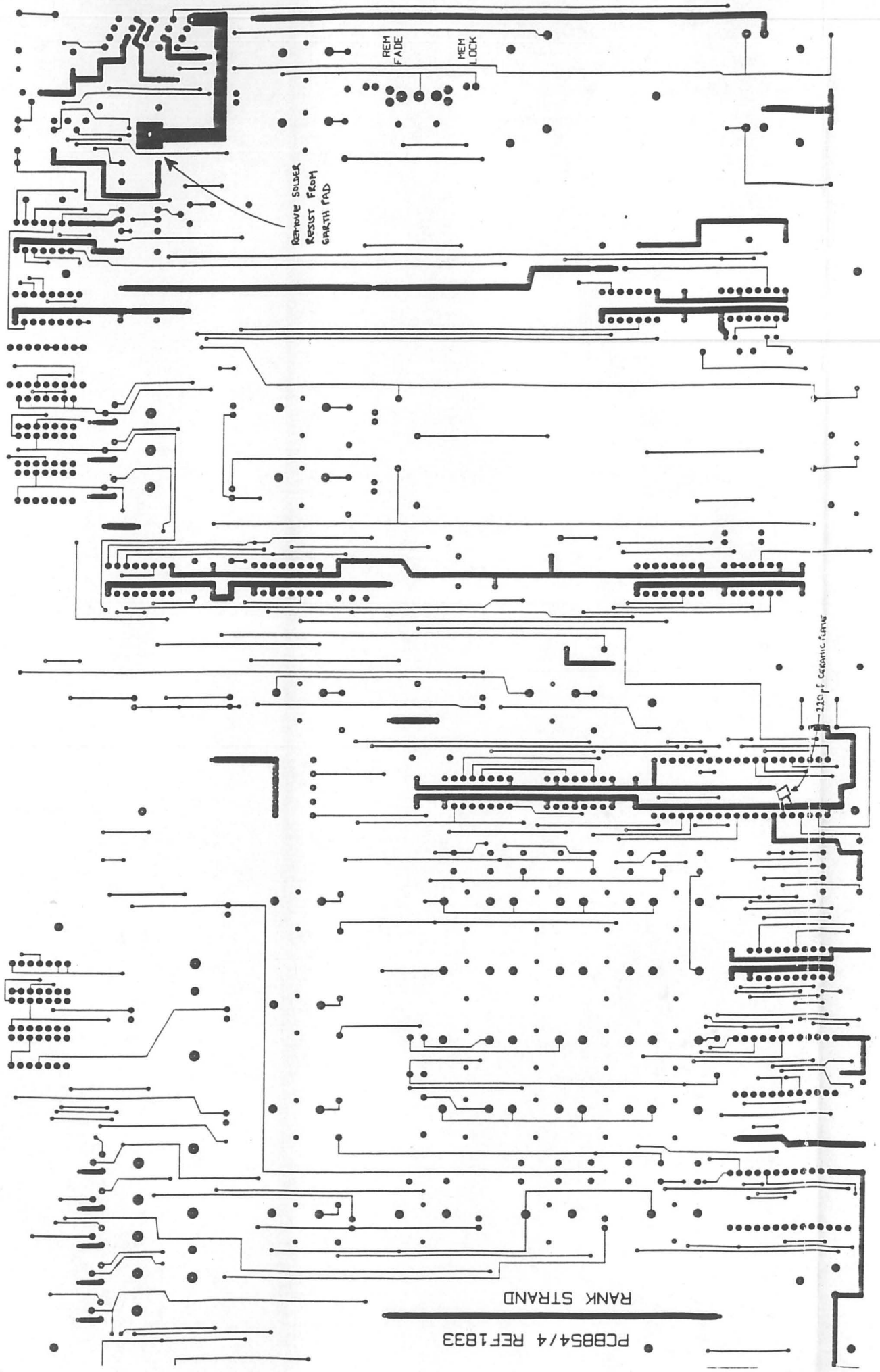
FIGURE 1

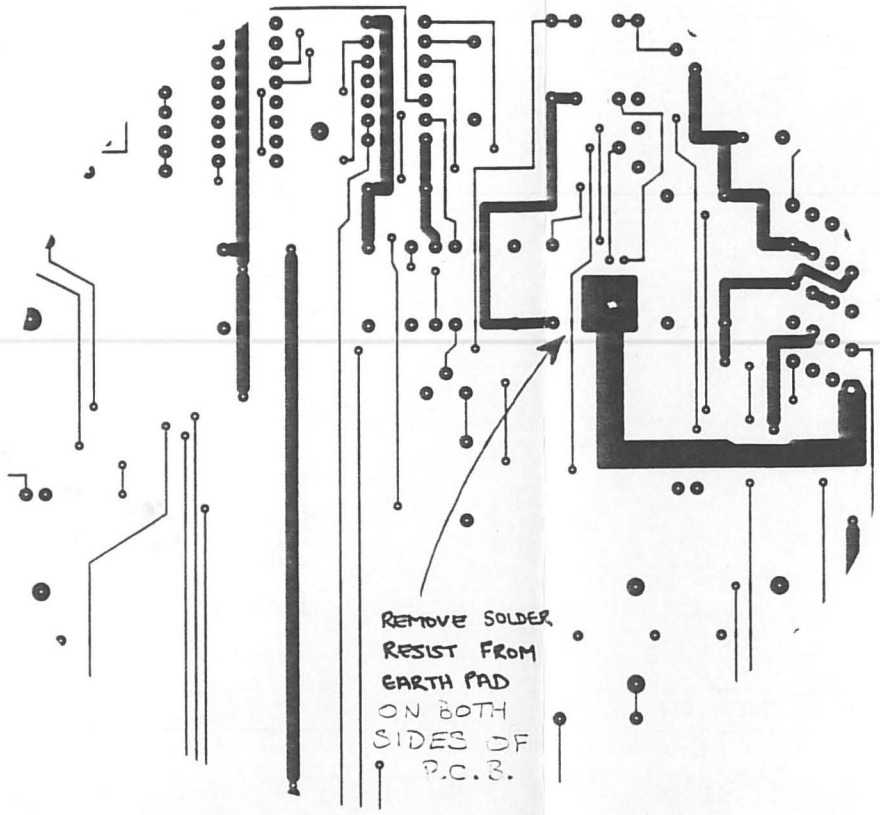




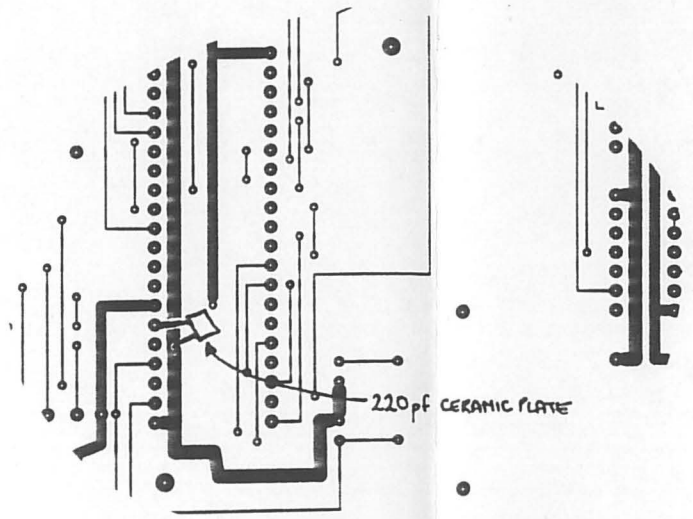
DETAILS OF MODIFICATION 1.1.1.

FIGURE 2.



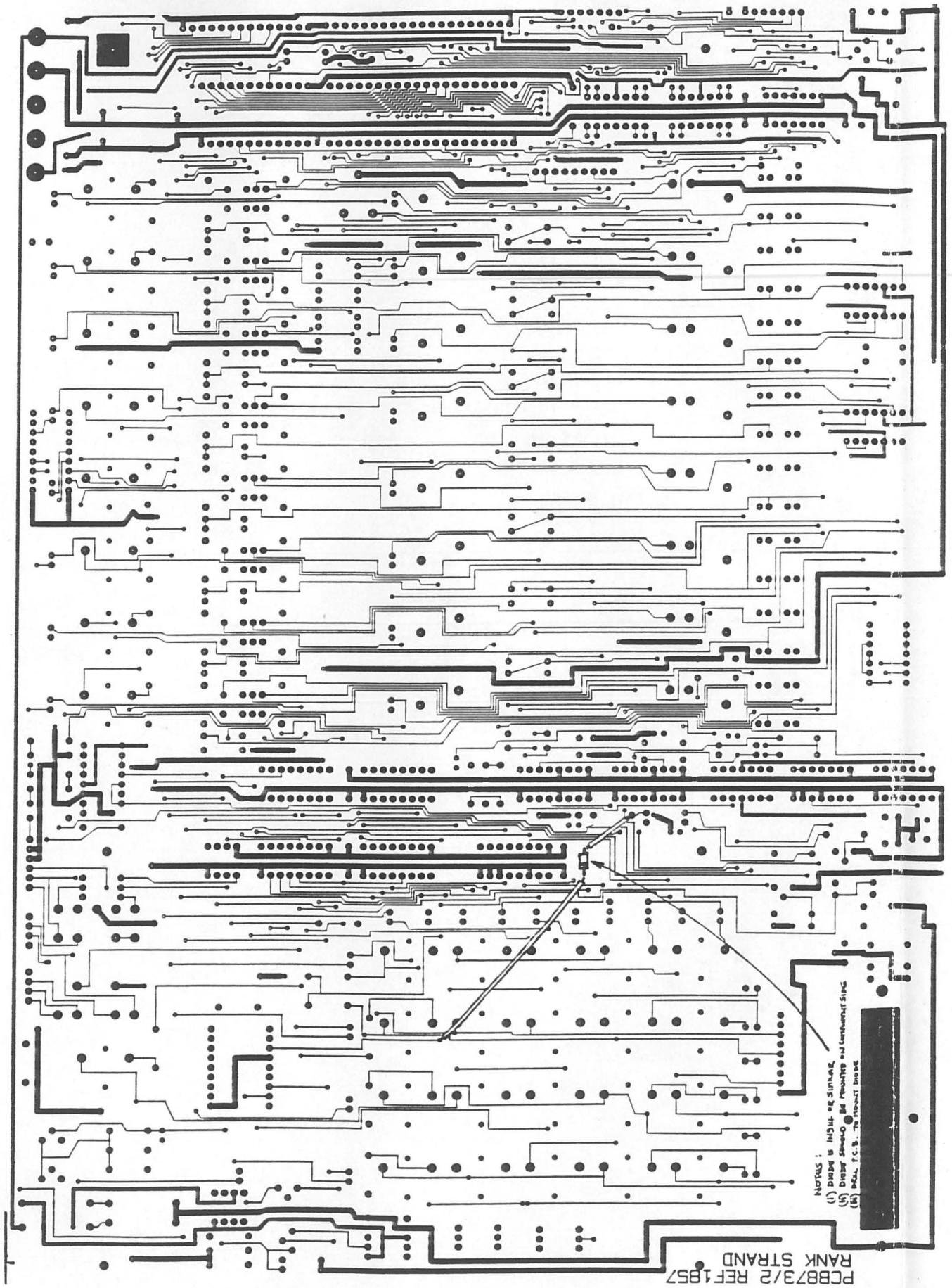


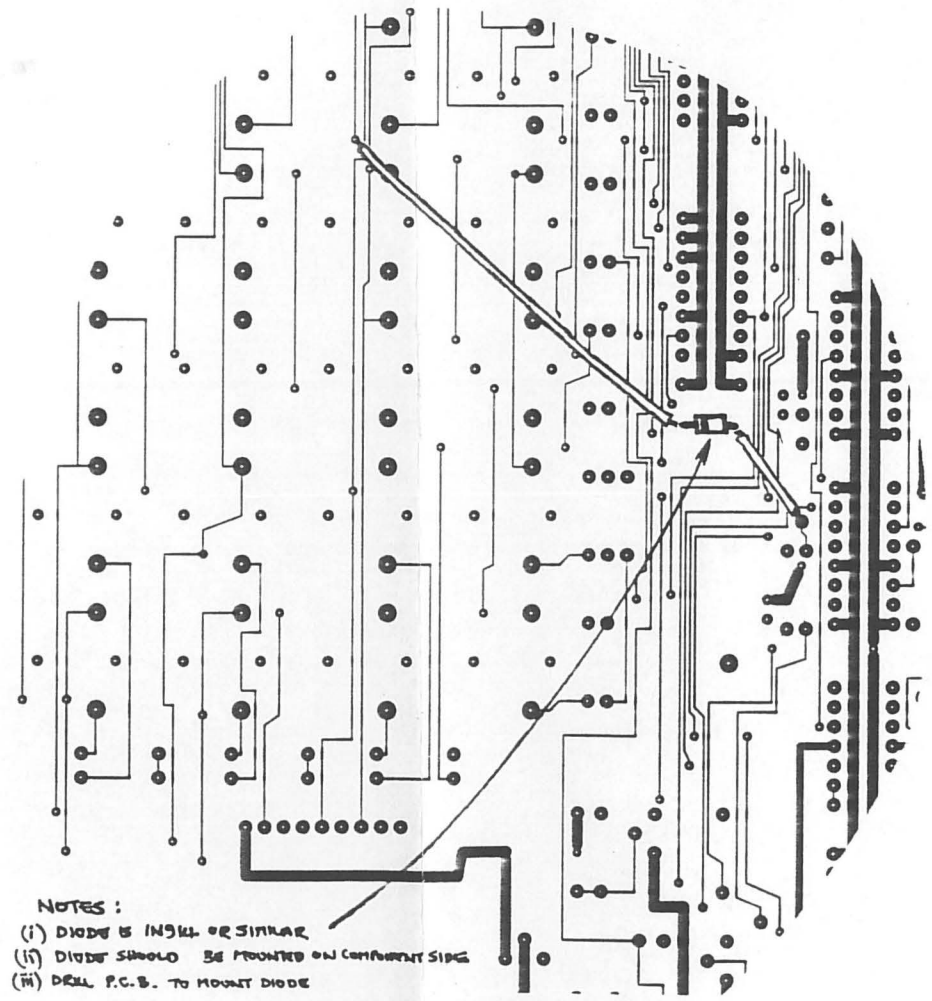
DETAILS OF MODIFICATION 1.2.2.



DETAILS OF MODIFICATION 1.2.1

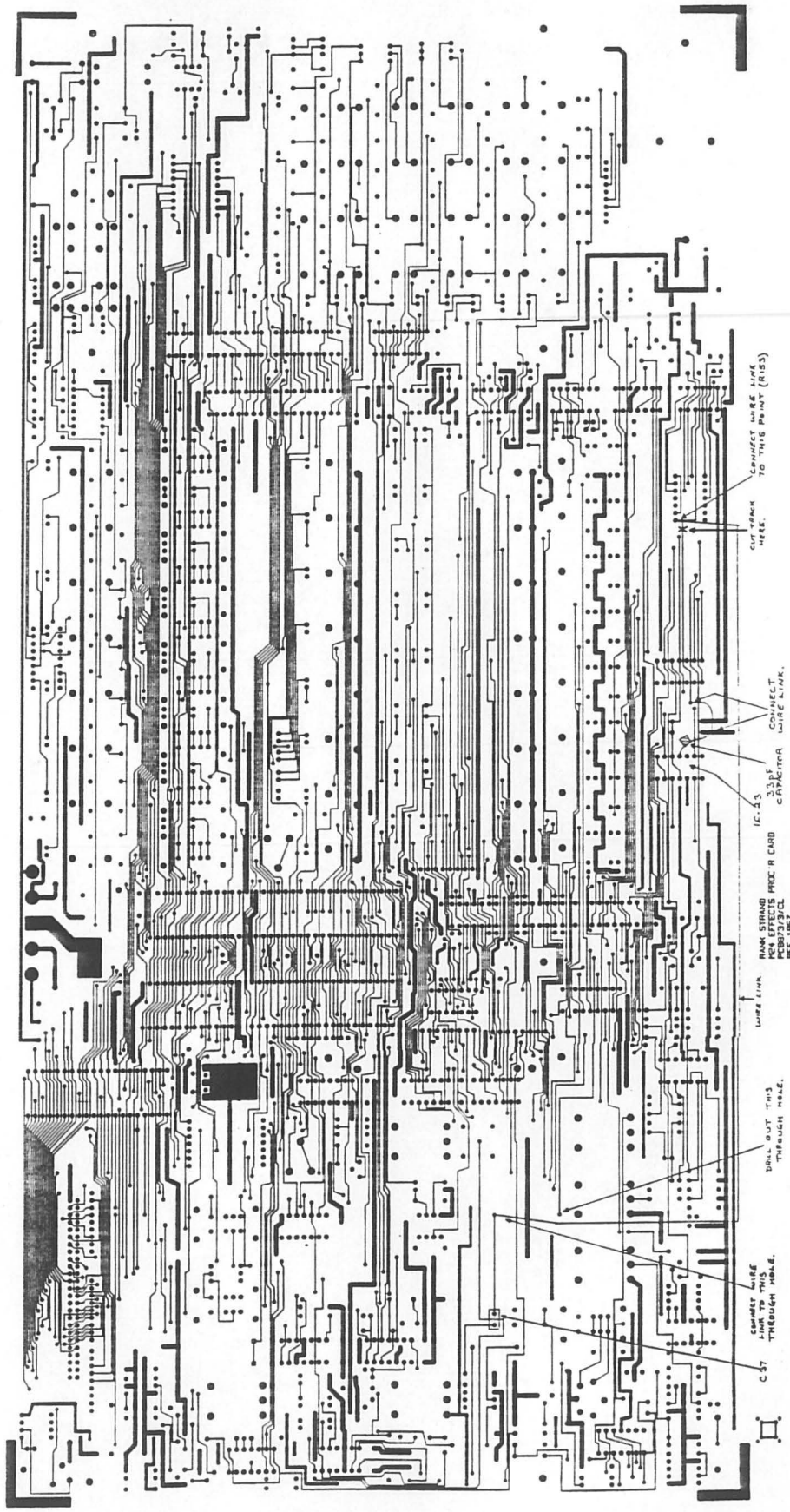
FIGURE 3





DETAILS OF MODIFICATION 1.5.1.

FIGURE 4.



DETAILS OF MODIFICATIONS 1.5.2 AND 1.5.4.